Air Conditioning & Refrigeration News

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VOL. 27, NO. 8, SERIAL NO. 535
ISSUED EVERY WEDNESDAY

DETROIT, MICHIGAN, JUNE 21, 1939

IN TWO PARTS, PART TWO
20 CENTS PER COPY

American Standard Safety Code For Mechanical Refrigeration

FOREWORD

This is the first revision of the Safety Code for Mechanical Refrigeration, as sponsored by The American Society of Refrigerating Engineers under the rules and regulations of the American Standards Association as Project B9.

Complete administrative details are not provided as they will necessarily vary in different states and municipalities.

Most of the refrigeration-producing equipment, household and commercial, is manufactured by companies whose business is nation-wide. It is, therefore, desirable that this Code be universally adopted so that safety provisions for refrigerating installations will be standardized, thereby permitting quantity production of refrigerating equipment with minimum cost to the user.

The refrigerating industry is continually changing, and it will undoubtedly be found that the present rules will need revision with further advancements in the art. For this purpose, a standing Sectional Committee is provided to formulate new rules for new types of refrigerating equipment, and uses of new refrigerants, as the demand requires.

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Section 1. SCOPE & PURPOSE

1.10 The application of this Code is intended to insure the safe design, construction, installation, operation and inspection of every Refrigerating System employing a fluid which is vaporized and liquefied in its refrigerating cycle, which may be used for the extraction of heat, including the preparation and preservation of food, the cooling and dehumidification of air for industrial purposes and for comfort, and as an aid to or a part in a chemical process.

1.20 This Code shall apply to Refrigerating Systems installed subsequent to its adoption and to parts replaced or added to systems installed prior to its adoption.

1.30 This Code is intended to provide reasonable safeguards to life, limb, health, and property; to correct certain practices which are inconsistent with safety; and to prescribe standards of safety which will properly influence future progress and developments in Refrigerating Systems.

Section 2. DEFINITIONS

2.10 Approved—Acceptable to the authorities having jurisdiction.

2.11 Brazed Joint—For the purpose of this Code, a brazed joint is a gas-tight joint, obtained by the joining of metal parts with alloys which melt at temperatures higher than 1,000° F. but less than the melting temperatures of the joined parts.

2.12 Brine—Any liquid, used for the transmission of heat without a change in its state, having no flash point or a flash point above 150° F. determined by American Society for Testing Materials method D56-36.

2.13 Compressor—A mechanical device used in a Refrigerating System for the purpose of increasing the pressure upon the refrigerant.

2.14 Condenser—A vessel or arrangement of pipe or tubing in which vaporized refrigerant is liquefied by the removal of heat.

2.15 Condensing Unit—A specific refrigerating machine combination consisting of a motor-driven compressor, a condenser, a liquid receiver, and the regularly furnished accessories.

2.16 Container—A cylinder for the transportation of refrigerant constructed to conform to the Specifications of the Interstate Commerce Commission as contained in their "Regulations for the Transportation by Rail of Explosives and other Dangerous Articles in Freight, Express and Baggage Services, including Specifications for Shipping Containers" effective October 1, 1930, with supplements 1 to 18 inclusive.

2.17 Department Store—The entire space occupied by one tenant or more than one tenant in an individual store where more than 100 persons commonly assemble on other than the street level floor for the purpose of buying personal wearables and other merchandise used in the home.

2.18 Design Working Pressure—The maximum allowable working pressure for which a vessel is designed.

2.19 Duct—A tube or conduit used for conveying air.

2.20 Evaporator—That part of the system in which liquid refrigerant is vaporized to produce refrigeration.

2.21 Expansion Coil—An evaporator constructed of pipe or tubing.

2.22 Fusible Plug—A device having a predetermined temperature fusible member for the relief of pressure.

2.23 Generator—Any device equipped with a heating element used in the Refrigerating System to increase the pressure of the refrigerant in its gas or vapor state for the purpose of liquefying the refrigerant.

2.24 Liquid Receiver—A vessel permanently connected to a system by inlet and outlet pipes for storage of a liquid refrigerant.

2.25 Machinery—Refrigerating equipment including any or all of the following: compressor, condenser, gen-

erator, absorber, receiver, connecting pipe, evaporator, or complete Unit System.

2.26 Machinery Room—A room in which is permanently installed and operated a Refrigerating System but not including evaporators located in a cold storage room, refrigerator box, air cooled space, or other enclosed space. Closets solely contained within and opening only into a room shall be considered a part of such room.

2.27 Machinery Room, Class T—A room having machinery other than flame producing apparatus permanently installed and operated and also having:

a. Doors which are tight-fitting, fire-resisting, and self-closing.

b. Walls which are vapor-tight and of approved fire resistive construction.

c. An exit door which opens directly to the outer air or through a vestibule-type exit equipped with self-closing, tight-fitting doors.

d. Exterior openings which, if present, are not under any fire escape or any open stairway.

e. All pipes piercing the interior walls or floor of such room, tightly sealed to the walls or floor through which they pass.

f. Emergency remote controls located immediately outside to stop the action of the refrigerant compressor.

g. Mechanical means for ventilation.

h. Emergency remote controls for the mechanical means of ventilation located outside.

2.28 Mechanical Joint—For the purpose of this Code, a mechanical joint is a gas-tight joint, obtained by the joining of metal parts through a positive-holding mechanical construction.

2.29 Piping—Pipe or tube mains for interconnecting the various parts of a Refrigerating System.

2.30 Pressure Limiting Device—A pressure responsive mechanism designed to automatically stop the operation of the compressor at a predetermined pressure.

2.31 Pressure Relief Device—A valve or rupture member designed to automatically relieve excessive pressure.

2.32 Pressure Relief Valve—A valve held closed by a spring or other means and designed to automatically relieve pressure in excess of its setting.

2.33 Pressure Vessel—Any refrigerant containing receptacle of a Refrigerating System other than expansion coils, headers, and pipe connections.

2.34 Refrigerant—A substance used to produce refrigeration by its expansion or vaporization.

2.35 Refrigerating System—A combination of interconnected refrigerant containing parts in which a refrigerant is circulated for the purpose of extracting heat.

2.36 Rupture Member—A device that will automatically rupture at a predetermined pressure.

2.37 Soldered Joint—For the purpose of this Code, a soldered joint is a gas-tight joint, obtained by the joining of metal parts with metallic mixtures or alloys which melt at temperatures below 1,000° F. and above 350° F.

2.38 Stop Valve—A shut-off for controlling the flow of refrigerant.

2.39 Tenant—As herein used a tenant shall be construed as a person, firm, or corporation possessed with the legal right to occupy premises.

2.40 Welded Joint—For the purpose of this Code, a welded joint is a gas-tight joint, obtained by the joining of metal parts in the plastic or molten state. (Abbreviated from American Standards Association Code for Pressure Piping, B31.1—1935.)

Section 3. BUILDING OCCUPANCY CLASSIFICATION

3.10 Locations in which Refrigerating Systems may be placed are grouped by occupancy as follows:

3.20 Institutional occupancy shall apply to that portion of a building in which persons are harbored to receive medical, charitable, educational, or other care or treatment, or in which persons are held or detained by reason of public or civic duty, including among others, hospitals, asylums, sanitariums, police stations, jails, court houses with cells, and similar occupancies.

3.30 Public Assembly occupancy shall apply to that portion of the premises in which persons congregate for civic, political, educational, religious, social, or recreational purposes; including among others, auditoriums, assembly rooms, armories, ball rooms, bath houses, broadcasting studios, colleges, court houses without cells, churches, dance halls, department stores, exhibition halls, fraternity halls, lodge rooms, mortuary chapels, museums, schools, libraries, passenger depots, subway stations, bus terminals, theaters, skating rinks, and similar occupancies.

3.40 Residential occupancy shall apply to that portion of a building in which sleeping accommodations are provided for more than two families, including among others, multiple story apartments, tenements, hotels, lodging houses, dormitories, convents, studios, club houses, and similar occupancies.

3.50 Commercial occupancy shall apply to that portion of a building used for the transaction of business; for the rendering of professional services; for the supplying of food, drink, or other bodily needs and comforts; for manufacturing purposes or for the performance of work or labor except as included under "Industrial" occupancies, including among others, office buildings, professional buildings, markets, restaurants, laboratories, bake shops, fur storage, loft buildings, stores other than department stores, and similar occupancies.

3.60 Industrial occupancy shall apply to an entire building when used by a single tenant for manufacturing, processing, or storage of materials or products, including among others, chemical, food, candy and ice cream factories, ice making plants, meat packing plants, refineries, perishable food warehouses, and similar occupancies, where a single tenant is defined as a single authority which operates and maintains the entire building and the Refrigerating System.

3.70 Mixed occupancy shall apply to a building occupied or used for different purposes in different parts. When the occupancies are cut off from the rest of the building by tight partitions, floors and ceilings and protected by self-closing doors, the requirements for each type of occupancy shall apply for its portion of the building. When the occupancies are not so separated, the occupancy carrying the more stringent requirements shall govern.

Section 4. REFRIGERATING SYSTEM CLASSIFICATION BY TYPE

4.10 Refrigerating Systems shall be divided into classes, descriptive of the method employed for extracting heat as follows:

4.20 Direct System is one in which the evaporator is in direct contact with the material or space refrigerated or is located in air circulating passages communicating with such spaces.

4.30 Unit System is one which has been assembled and tested prior to its installation and which is installed without connecting any refrigerant containing parts.

4.40 Indirect System is one in which a liquid, such as brine or water, cooled by the refrigerant, is circulated to the material or space refrigerated or is used to cool air so circulated. Indirect Systems which are distinguished by the type or method of application are as follows:

4.41 Indirect Open Spray System is one in which a liquid, such as brine or water, cooled by an evaporator located in an enclosure external to a cooling chamber, is circulated to such cooling chamber and is sprayed therein.

4.42 Indirect Closed Surface System is one in which a liquid, such as brine or water, cooled by an evaporator located in an enclosure external to a cooling chamber, is circulated to and through such a cooling chamber in pipes or other closed circuits.

4.43 Indirect Vented Closed Surface System is one in which a liquid, such as brine or water, cooled by an evaporator located in a vented enclosure external to a cooling chamber, is circulated to and through such cooling chamber in pipes or other closed circuits.

4.44 Double Indirect Vented Open Spray System is one in which a liquid, such as brine or water, cooled by an evaporator located in a vented enclosure, is circulated through a closed circuit to a second enclosure where it cools another supply of a liquid, such as brine or water, and this liquid in turn is circulated to a cooling chamber and is sprayed therein.

4.45 Indirect Absorptive Brine System is an Indirect Vented Open Spray System in which the brine will chemically absorb the refrigerant in the system, and the chemical compound so formed in the solution will be stable at temperatures up to 100° F. The brine shall be of such quantity and concentration that it will absorb twice the total quantity of refrigerant in the system. An approved automatic device shall be provided for shutting down the system when the brine concentration becomes such that the brine will absorb only one and one-half times the total quantity of refrigerant in the system.

4.46 Double Refrigerant System is one in which a refrigerant is used in the secondary circuit instead of brine or water. For the purpose of this Code, each circuit shall be considered as a separate Direct Refrigerating System.

4.50 The Direct and various Indirect Systems referred to above are illustrated in Fig. 1.

Section 5. REFRIGERANT CLASSIFICATION

5.10 Refrigerants shall, for Safety Code purposes, be divided into groups as follows:

5.11 Group 1 — *Chemical Formula*

Carbon dioxide ..... CO_2
Dichlorodifluoromethane (Freon-12) CCl_2F_2
Dichloromonofluoromethane (Freon-21) $CHCl_2F$
Dichlorotetrafluoroethane (Freon-114) $C_2Cl_2F_4$
Dichloromethane (Carrene No. 1) (Methylene chloride) CH_2Cl_2
Trichloromonofluoromethane (Freon-11) (Carrene No. 2) CCl_3F

5.12 Group 2

Ammonia ..... NH_3
Dichloroethylene ..... $C_2H_2Cl_2$
Ethyl chloride ..... C_2H_5Cl
Methyl chloride ..... CH_3Cl
Methyl formate ..... $HCOOCH_3$
Sulphur dioxide ..... SO_2

5.13 Group 3

Butane ..... C_4H_{10}
Ethane ..... C_2H_6
Isobutane ..... $(CH_3)_3CH$
Propane ..... C_3H_8

Section 6. INSTITUTIONAL OCCUPANCIES

General

6.10 No Refrigerating System shall be installed in or on public stairways, hallways, lobbies, entrances or exits.

6.11 Refrigerant piping or tubing shall not be carried through floors except that for the purpose of connecting to a condenser on the roof, it may be carried through a continuous, rigid and tight fire-resisting (four (4) hour rating) flue or shaft having no openings on intermediate floors, or it may be carried on the outer wall of the building provided it is not located in an air shaft, closed court or in other similar open spaces enclosed within the outer walls of the building.

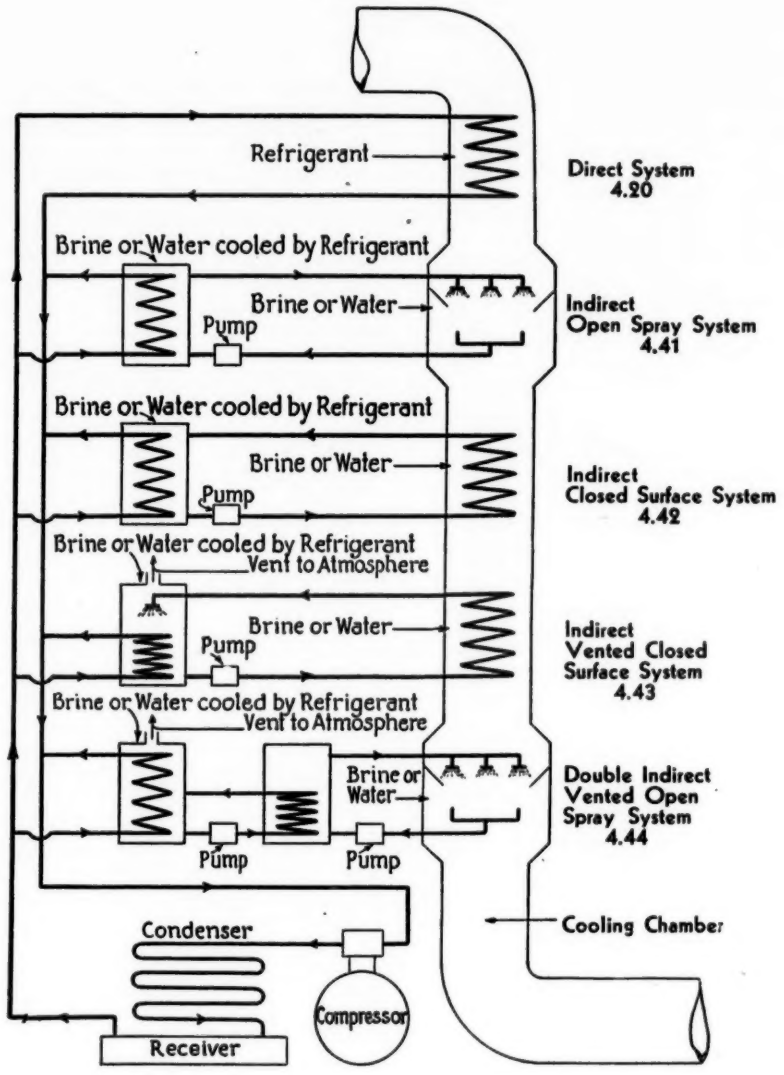
Group 1 Refrigerants

6.20 No Refrigerating System shall be installed in any room except Unit Systems each containing not more than ten (10) pounds of a Group 1 refrigerant, and then only when a window or other ventilation is provided, and except as otherwise permitted.

6.21 Systems each containing not more than twenty (20) pounds of a Group 1 refrigerant may be installed in kitchens, laboratories, and mortuaries.

6.22 Systems each containing more than twenty (20) pounds of a Group 1 refrigerant shall be of the Indirect

Figure 1



type with all refrigerant containing parts, excepting parts installed outside the building, installed in a machinery room, used for no other purpose and in which for Group 1 refrigerants, excepting carbon dioxide, no flame is present or apparatus to produce a flame is installed.

6.23 When a Group 1 refrigerant, other than carbon dioxide, is used in a system any portion of which is in a room where there is an apparatus for producing an open flame, then such refrigerant shall be classed in Group 2 unless the flame producing apparatus is provided with a hood and flue capable of removing the products of combustion to the open air. Flames by matches, cigarette lighters, small alcohol lamps and similar devices, shall not be considered as open flames.

Group 2 Refrigerants

6.30 Group 2 refrigerants shall not be used except in Unit Systems containing not more than six (6) pounds of refrigerant when installed in kitchens, laboratories, or mortuaries, or except in systems containing not more than five hundred (500) pounds of refrigerant and having all refrigerant containing parts installed in a Class T machinery room.

6.31 Group 2 refrigerants shall not be used in a system for air conditioning for human comfort, except in an Indirect Vented Closed Surface System, or in a Double Indirect Vented Open Spray System, or in an Indirect Absorptive Brine System.

Group 3 Refrigerants

6.40 Group 3 refrigerants shall not be used in Institutional occupancies.

Section 7. PUBLIC ASSEMBLY OCCUPANCIES

General

7.10 No Refrigerating System shall be installed in or on public stairways, hallways, lobbies, entrances or exits.

7.11 Refrigerant piping or tubing shall not be carried through floors except from basements to the first floor or from the top floor to a penthouse or the roof, or except that for the purpose of connecting to a condenser on the roof it may be carried through a continuous, rigid and tight fire-resisting (four (4) hour rating) flue or shaft having no openings on intermediate floors or it may be carried on the outer wall of the building provided it is not located in an air shaft, closed court or in other similar open spaces enclosed within the outer walls of the building.

Group 1 Refrigerants

7.20 The maximum quantity of a Group 1 refrigerant in a Direct System used for air conditioning for human comfort shall be limited by the volume of the space to be air conditioned as shown in the table at the top of this column.

Refrigerant	Chemical Formula	Maximum Quantity In Lbs. Per 1,000 Cu. Ft. of Air-Conditioned Space*
Carbon dioxide	CO_2	12
Dichlorodifluoromethane (Freon-12)	CCl_2F_2	30
Dichloromethane (Carrene No. 1)	CH_2Cl_2	6
Dichloromonofluoromethane (Freon-21)	$CHCl_2F$	13
Dichlorotetrafluoroethane (Freon-114)	$C_2Cl_2F_4$	40
Trichloromonofluoromethane (Freon-11)	CCl_3F	35

*Notes

a. When the refrigerant containing parts of a system are located in one or more enclosed spaces, the cubical contents of the smallest enclosed space other than the machinery room, shall be used to determine the permissible quantity of refrigerant in the system.

b. When the evaporator is located in a duct system, the cubical content of the smallest enclosed space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system unless the airflow to any enclosed space served by the duct system cannot be reduced below ¼ of its maximum, in which case the cubical contents of the entire space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system.

7.21 A system containing more than fifty (50) pounds of a Group 1 refrigerant, other than carbon dioxide, and which includes air ducts shall be of the Indirect type unless it conforms to requirements as follows:

a. Positive automatic fire damper or dampers shall be provided to cut off the refrigerant containing apparatus from the duct system.

b. Automatic means shall be provided to close the dampers and to stop the fan when the temperature of the air in the duct at the damper location reaches 210° F. when the damper is on the discharge side of a system containing a heating coil and at 125° F. when the damper is on the suction side of the system, or on the discharge side of a system containing no heating coil.

7.22 A system containing more than one thousand (1,000) pounds of a Group 1 refrigerant shall be of the Indirect type with all the refrigerant containing parts, excepting parts mounted outside the building, installed in a machinery room used for no other purpose and in which for Group 1 refrigerants, excepting carbon dioxide, no flame is present or apparatus to produce a flame is installed.

7.23 When a Group 1 refrigerant, other than carbon dioxide, is used in a system, any portion of which is in a room where there is an apparatus for producing an open flame, then such refrigerant shall be classed in Group 2 unless the flame producing apparatus is provided with a hood and flue capable of removing the products of combustion to the open air. Flames by matches, cigarette lighters, small alcohol lamps and similar devices, shall not be considered as open flames.

Group 2 Refrigerants

7.30 Group 2 refrigerants shall not be used except in Unit Systems containing not more than twelve (12) pounds of refrigerant, or except in systems containing not more than one thousand (1,000) pounds of refrigerant and having all refrigerant containing parts installed in a Class T machinery room.

7.31 Group 2 refrigerants shall not be used in a system for air conditioning for human comfort, except in an Indirect Vented Closed Surface System, or in a Double Indirect Vented Open Spray System, or in an Indirect Absorptive Brine System.

Group 3 Refrigerants

7.40 Group 3 refrigerants shall not be used in Public Assembly occupancies.

Section 8. RESIDENTIAL OCCUPANCIES

General

8.10 No Refrigerating System shall be installed in or on public stairways.

8.11 No Refrigerating System shall be installed in public hallways, lobbies, entrances, or exits, except Unit Systems containing not more than four (4) pounds of a refrigerant, provided free passage is not obstructed.

8.12 Refrigerant piping shall not be carried through floors except as follows:

a. It may be carried from basements to the first floor or from the top floor to a penthouse or the roof.

b. For the purpose of connecting to a condenser on the roof it may be carried through an approved, rigid and tight continuous fire-resisting flue or shaft having no openings on intermediate floors, or it may be carried on the outer wall of the building provided it is not located in an air shaft, closed court, or in other similar open spaces enclosed within the outer walls of the building.

c. In systems containing Group 1

refrigerants and used for air conditioning for human comfort, the refrigerant piping may be carried through floors provided it is enclosed in an approved, rigid and tight continuous fire-resisting flue or shaft where it passes through any intermediate space not served by the air-conditioning system. The flue shall be vented to the outside or to a space served by the air conditioning system. Such systems shall conform to the requirements of paragraph 8.20.

Group 1 Refrigerants

8.20 The maximum quantity of refrigerants in a Direct System used for air conditioning for human comfort, shall be limited by the volume of the space to be air conditioned as follows:

* * *

Refrigerant	Chemical Formula	Maximum Quantity In Lbs. Per 1,000 Cu. Ft. of Air-Conditioned Space*
Carbon dioxide	CO_2	12
Dichlorodifluoromethane (Freon-12)	CCl_2F_2	30
Dichloromethane (Carrene No. 1)	CH_2Cl_2	6
Dichloromonofluoromethane (Freon-21)	$CHCl_2F$	13
Dichlorotetrafluoroethane (Freon-114)	$C_2Cl_2F_4$	40
Trichloromonofluoromethane (Freon-11)	CCl_3F	35

*Notes

a. When the refrigerant containing parts of a system are located in one or more enclosed spaces, the cubical contents of the smallest enclosed space other than the machinery room, shall be used to determine the permissible quantity of refrigerant in the system.

b. When the evaporator is located in a duct system, the cubical content of the smallest enclosed space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system unless the airflow to any room served by the duct system cannot be reduced below ¼ of its maximum, in which case the cubical contents of the entire space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system.

* * *

8.21 A system containing more than fifty (50) pounds of a Group 1 refrigerant, other than carbon dioxide, and which includes air ducts shall be of the Indirect type unless it conforms to requirements as follows:

a. Positive automatic fire damper or dampers shall be provided to cut off the refrigerant containing apparatus from the duct system.

b. Automatic means shall be provided to close the dampers and to stop the fan when the temperature of the air in the duct at the damper location reaches 210° F. when the damper is on the discharge side of a system containing a heating coil and at 125° F. when the damper is on the suction side of the system, or on the discharge side of a system containing no heating coil.

8.22 A system containing more than one thousand (1,000) pounds of a Group 1 refrigerant shall be of the Indirect type with all the refrigerant containing parts, excepting parts mounted outside the building, installed in a machinery room used for no other purpose and in which for Group 1 refrigerants, excepting carbon dioxide, no flame is present or apparatus to produce a flame is installed.

Group 2 Refrigerants

8.30 No system containing more than six (6) pounds of a Group 2 refrigerant shall be located in sleeping rooms, or spaces directly connected to sleeping rooms.

8.31 No system containing a Group 2 refrigerant shall be used for air conditioning for human comfort unless it it of the Indirect Vented Closed Surface, Double Indirect Vented Open Spray, Indirect Absorptive Brine, or primary circuit of a Double Refrigerant type with all the refrigerant containing parts, excepting parts mounted outside the building, installed in a machinery room used for no other purpose.

8.32 Any system containing more than three hundred (300) pounds of a Group 2 refrigerant shall have all refrigerant containing parts installed in a Class T machinery room.

Group 3 Refrigerants

8.40 Group 3 refrigerants shall not be used except in a Unit System containing not more than six (6) pounds of refrigerant.

Section 9. COMMERCIAL OCCUPANCIES

General

9.10 No Refrigerating System shall be installed in or on public stairways.

9.11 No Refrigerating System shall be installed in public hallways, lobbies, entrances, or exits, except Unit Systems containing not more than four (4) pounds of a refrigerant, provided free passage is not obstructed.

9.12 Refrigerant piping shall not be carried through floors except as follows:

a. It may be carried from basements to the first floor or from the top floor to a penthouse or the roof.

b. For the purpose of connecting to a condenser on the roof it may be carried through an approved, rigid and tight continuous fire-resisting flue or shaft having no openings on intermediate floors, or it may be carried on the outer wall of the building provided it is not located in an air shaft, closed court, or in other similar open spaces enclosed within the outer walls of the building.

c. In systems containing Group 1 refrigerants and used for air conditioning for human comfort, the refrigerant piping may be carried through floors provided it is enclosed in an approved, rigid and tight continuous fire-resisting flue or shaft where it passes through any intermediate space not served by the air-conditioning system. The flue shall be vented to the outside or to a space served by the air conditioning system. Such systems shall conform to the requirements of paragraph 9.20.

Group 1 Refrigerants

9.20 Direct Systems containing more than twenty (20) pounds of a Group 1 refrigerant when used for air conditioning for human comfort, shall be limited by the volume of the space to be air conditioned as follows:

* * *

Refrigerant	Chemical Formula	Maximum Quantity In Lbs. Per 1,000 Cu. Ft. of Air-Conditioned Space*
Carbon dioxide	CO_2	12
Dichlorodifluoromethane (Freon-12)	CCl_2F_2	30
Dichloromethane (Carrene No. 1)	CH_2Cl_2	6
Dichloromonofluoromethane (Freon-21)	$CHCl_2F$	13
Dichlorotetrafluoroethane (Freon-114)	$C_2Cl_2F_4$	40
Trichloromonofluoromethane (Freon-11)	CCl_3F	35

*Notes

a. When the refrigerant containing parts of a system are located in one or more enclosed spaces, the cubical contents of the smallest enclosed space other than the machinery room, shall be used to determine the permissible quantity of refrigerant in the system.

b. When the evaporator is located in a duct system, the cubical content of the smallest enclosed space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system unless the airflow to any room served by the duct system cannot be reduced below ¼ of its maximum, in which case the cubical contents of the entire space served by the duct system shall be used to determine the permissible quantity of refrigerant in the system.

9.21 A system containing more than fifty (50) pounds of a Group 1 refrigerant, other than carbon dioxide, and which includes air ducts shall be of the Indirect type unless it conforms to requirements as follows:

a. Positive automatic fire damper or dampers shall be provided to cut off the refrigerant containing apparatus from the duct system.

b. Automatic means shall be provided to close the dampers and to stop the fan when the temperature of the air in the duct at the damper location reaches 210° F. when the damper is on the discharge side of a system containing a heating coil and at 125° F. when the damper is on the suction side of the system or on the discharge side of a system containing no heating coil.

9.22 A system containing more than one thousand (1,000) pounds of a Group 1 refrigerant shall be of the Indirect type with all the refrigerant containing parts, excepting parts mounted outside the building, installed in a machinery room used for no other purpose and in which for Group 1 refrigerants, excepting carbon dioxide, no flame is present or apparatus to produce a flame is installed.

Group 2 Refrigerants

9.30 A system containing more than twenty (20) pounds of a Group 2 refrigerant shall not be used for air conditioning for human comfort unless it is of the Indirect Vented Closed Surface, Double Indirect Vented Open Spray, Indirect Absorptive Brine, or primary circuit of a Double Refrigerant type with all the refrigerant containing parts, excepting parts mounted outside the building, installed in a machinery room used for no other purpose.

9.31 Any system containing more than six hundred (600) pounds of a Group 2 refrigerant shall have all refrigerant containing parts installed in a Class T machinery room.

Group 3 Refrigerants

9.40 Group 3 refrigerants shall not be used except in a Unit System containing not more than six (6) pounds of refrigerant.

Section 10. INDUSTRIAL OCCUPANCIES

10.10 There shall be no restriction on the quantity or kind of refrigerant used in an Industrial occupancy, except as specified in paragraph 10.20.

10.20 When the number of employes above the first floor exceeds one per one hundred (100) square feet of floor area, the requirements of Commercial occupancies shall apply unless that portion of the building containing more than one employe per one hundred (100) square feet of floor area above the first floor, together with its entrances and exits, be cut off from the rest of the building by vapor-tight construction with self-closing, tight-fitting doors.

Section 11. INSTALLATION REQUIREMENTS

Condensing Units

11.10 Not more than two (2) condensing units shall be located one above the other within the same floor area between floor and ceiling.

11.11 All moving machinery shall be provided with adequate guards in accordance with the American Standard Safety Code for Mechanical Power Transmission Apparatus, B15-1927.

11.12 Adequate illumination and clear space for inspection and servicing of condensing units shall be provided.

11.13 Condensing units with enclosures shall be readily accessible for servicing and inspection.

Water Connections

11.20 No connection shall be made with the public water supply which is inconsistent with the regulations of the public authority having jurisdiction. Water used for removing heat from a Refrigerating System shall not be discharged into any water supply where the water is used for drinking purposes.

11.21 Discharge water lines from condensers or other equipment shall not be directly connected to the waste or sewer system in such a manner as to permit siphoning of the waste water into the water supply lines. The waste or discharge from such equipment shall be over and above the rim of a properly trapped and vented plumbing fixture.

Electrical Wiring

11.30 The installation of all electrical equipment and wiring shall be in accordance with the requirements of the latest edition of the National Electrical Code, as approved by American Standards Association.

Gas Devices

11.40 The installation of all gas fuel devices and equipment used with Refrigerating Systems shall be in accordance with the latest edition of National Board of Fire Underwriters' Pamphlet No. 54 entitled "Recommended Good Practice Requirements for Installation, Maintenance and Use of Piping and Fittings for City Gas," as approved by American Standards Association.

Open Flames

11.50 When the quantity of refrigerant in any one Refrigerating System exceeds the amount given in the following table for each one thousand (1,000) cubic feet of room volume in which the system or any part thereof is installed, then no flame producing device or hot surfaces above 800° F. shall be permitted in such room and all electrical equipment in the room shall conform to the requirements of Article 500—Hazardous Locations Class I of the latest edition of the National Electrical Code as approved by American Standards Association.

Refrigerant	Chemical Formula	Maximum Quantity In Lbs. Per 1,000 Cu. Ft. Of Room Volume
Butane	C_4H_{10}	3
Ethane	C_2H_6	3
Ethyl chloride	C_2H_5Cl	6
Isobutane	$(CH_3)_3CH$	3
Methyl chloride	CH_3Cl	10
Methyl formate	$HCOOCH_3$	7
Propane	C_3H_8	3

Machinery Room

11.60 Each refrigerating machinery room shall be provided with tight-fitting door or doors and have no partitions or openings that will permit the passage of the refrigerant to other parts of the building.

11.61 Each refrigerating machinery room shall be provided with means for ventilation to the outer air. The ventilation shall consist of windows or doors opening to the outer air, of the size shown in Table 1, or of mechanical means capable of removing the air from the room in accordance with Table 1. The amount of ventilation for refrigerant removal purposes shall be determined by the refrigerant content of the largest system in the machinery room.

11.62 When mechanical means are used, they shall consist of a power-driven exhaust fan, which shall be capable of removing from the refrigerating machinery room the amount of air specified in Table 1. The inlet to the fan shall be located near the refrigerating equipment. The outlet from the fan shall terminate outside of the building. When air ducts are used on either the inlet or discharge side of the fan, they shall each have an area not less than specified in Table 1.

11.63 Class T machinery rooms in basements or sub-basements shall have adequate mechanical ventilation operating continuously, which may be considered as a part of the emergency ventilation required in paragraph 11.61.

Air Duct Systems

11.70 The installation of all Air Duct Systems of air conditioning equipment using mechanical refrigeration

Table 1. Duct Areas & Openings

Weight of Refrigerant In System, Lbs.	Mechanical Cu. Ft. Per Minute Discharge	Duct Area, Sq. Ft.	Open Window Or Door Area, Sq. Ft.
Up to 20	150	¼	4
50	250	⅓	6
100	400	½	10
150	550	⅔	12½
200	680	⅔	14
250	800	1	15
300	900	1	17
400	1,100	1¼	20
500	1,275	1¼	22
600	1,450	1½	24
700	1,630	1½	26
800	1,800	2	28
900	1,950	2	30
1,000	2,050	2	31
1,250	2,250	2¼	33
1,500	2,500	2¼	37
1,750	2,700	2¼	38
2,000	2,900	2¼	40
2,500	3,300	2½	43
3,000	3,700	3	48
4,000	4,600	3¾	55
5,000	5,500	4½	62
6,000	6,300	5	68
7,000	7,200	5½	74
8,000	8,000	5¾	80
9,000	8,700	6¼	85
10,000	9,500	6½	90
12,000	10,900	7	100
14,000	12,200	7½	109
16,000	13,300	7¾	118
18,000	14,300	8	125
20,000	15,200	8¼	130
25,000	17,000	8¾	140
30,000	18,200	9	145
35,000	19,400	9¼	150
40,000	20,500	9½	155
45,000	21,500	9¾	160

for human comfort shall be in accordance with the requirements of the American Standard Regulations for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems Z33.2-1938 and all subsequent revisions thereof approved by American Standards Association.

Indirect Open Spray Systems

11.80 Indirect Open Spray Systems containing more than one thousand (1,000) pounds of a Group 1 refrigerant shall be provided with approved means of preventing the escape of refrigerant into the spray system, except when the vapor pressure of the refrigerant at 32° F. does not exceed atmospheric pressure.

Section 12*. REFRIGERANT PIPING, VALVES, FITTINGS AND RELATED PARTS

Materials

12.10 All materials used in the construction and installation of Refrigerating Systems shall be suitable for the refrigerant used, and no material shall be used that will deteriorate due to the chemical action of the refrigerant or the oil, or the combination of both.

Steel and Wrought Iron Pipe

12.11 Standard weight steel or wrought iron pipe may be used for Design Working Pressures not exceeding two hundred fifty (250) pounds per square inch, provided lap welded or seamless pipe is used for sizes larger than two (2) inches (iron pipe size) and extra heavy pipe is used for liquid lines for sizes one and one-half (1½) inches (iron pipe size) and smaller.

12.12 Pipe joints may be screwed, flanged or welded. Screw joints shall conform to American Standards Association Pipe Thread Standard No. B2-1919. Exposed threads shall be tinned or otherwise coated to inhibit corrosion.

12.13 Welds shall conform to the Welding Section of the American Standards Association Code for Pressure Piping B31-1935.

12.14 Valves, flanges and fittings may be made of cast iron, malleable iron, bronze or steel castings, hot forged or drop forged steel, wrought copper, bronze or brass, and shall be of the design and material listed by the manufacturer for the particular refrigerant service.

12.15 Cast iron shall conform to American Society for Testing Materials designation A-126-30, Class B higher strength gray iron with not less than thirty thousand (30,000) pounds per square inch tensile strength.

12.16 Bushings may be used in fittings when the reduction is two or more pipe sizes. For single pipe size reduction, reducing fittings must be used.

Pipe Bends

12.17 Pipe bends shall be substantially circular in section and free from injurious wrinkles, buckles, kinks and creases. This shall not be construed as barring corrugated pipe bends made of suitable material.

Brass Pipe

12.18 Standard pipe size copper or red brass (not less than eighty (80) per cent copper) may be used.

*The provisions of this section apply to piping, valves, fittings and related parts for Design Working Pressures not exceeding two hundred fifty (250) pounds per square inch gauge.

Copper Tubing

12.20 Copper tubing used for refrigerant piping erected on the premises shall conform to American Society for Testing Materials designation B-88-33, grades K or L for dimensions, and shall be absolutely free from scale and dirt.

12.21 Copper tubing of one-eighth (⅛), one-quarter (¼), and five-eighths (⅝) inch nominal sizes in the same standard series as grades K or L of American Society for Testing Materials designation B-88-33, shall be considered as meeting the requirements of paragraph 12.20.

Soft Copper Tubing

12.22 Soft annealed copper tubing used for refrigerant piping erected on the premises shall not be used in sizes larger than three-quarters (¾) inch nominal size. It shall conform to grades K or L of American Society for Testing Materials designation B-88-33.

12.23 Rigid metal enclosures shall be provided for soft annealed copper tubing used for refrigerant piping erected on the premises, except that flexible metal enclosures may be used at bends or terminals if not exceeding six (6) feet in length. No enclosures shall be required for connections between condensing unit and the nearest riser box, provided such connections do not exceed six (6) feet in length.

12.24 Threaded joints on copper or brass pipe of standard pipe size shall be made with extra heavy brass fittings which conform to Federal Specifications WW-P-461 composition B, Feb. 2, 1932.

12.25 Joints on annealed copper tubing not exceeding three-quarters (¾) inch in outside diameter may be made with flared compression fittings of approved type, provided that all such fittings shall be exposed for visual inspection.

12.26 Joints on hard drawn copper tubing, if of the sweated capillary type, may be made with an alloy having a melting point greater than 1,000° F. or with a solder melting at a point below 500° F., but above 350° F.

12.27 Fittings used in sweated capillary joints shall be cast red brass or die pressed brass or copper, or wrought brass or copper, or extruded brass or copper.

12.28 Soldered joints in pipe or tubing erected on the premises shall remain mechanically intact when subjected to a pull-apart test equivalent to a pressure of not less than three hundred (300) pounds per square inch gauge

pressure with a temperature of not less than 800° F., except that this requirement shall not apply to soldered joints in pipe or tubing of one-half (½) inch nominal size or smaller when used in systems containing not more than twenty (20) pounds of refrigerant.

12.29 Any evaporator located in an air duct of an air conditioning system for human comfort shall be constructed to withstand without leakage a temperature of 1,000° F.

Stop Valves

12.30 Stop valves shall be installed on all systems containing more than twenty (20) pounds but less than one hundred (100) pounds of refrigerant at locations as follows:

a. Each inlet and each outlet pipe of each compressor.

b. Each outlet of each liquid receiver.

12.31 Stop valves shall be installed on all systems containing one hundred (100) pounds or more of refrigerant at locations as follows:

a. Each inlet and each outlet pipe of each compressor.

b. Each inlet and each outlet pipe of each liquid receiver.

c. Each liquid and each suction branch header.

12.32 Stop valves used with soft annealed copper tubing or hard drawn copper tubing three-quarter (¾) inch nominal size or smaller shall be securely mounted independent of tubing fastenings or supports.

12.33 Stop valves placed where it is not obvious what they control shall be suitably labelled. Numbers may be used to label the valves provided a key to the number is located near the valves.

Pipe and Tube Supports

12.40 All refrigerant piping shall be securely supported by means of metal hangers, brackets, straps, clamps or pedestals, in such manner as to relieve joints of harmful strains and vibration. The supports shall be used for no other purpose. Hangers for refrigerant piping above seven-eighths (⅞) inch outside diameter, shall not be less than 0.125 square inch cross section.

Location of Refrigerant Piping

12.50 Refrigerant piping crossing an open space which affords passageway in any building shall not be less than seven and one-half (7½) feet above the floor unless against the ceiling of such space.

12.51 Refrigerant piping shall not be placed in public hallways, lobbies, stairways, elevators or dumbwaiter shafts, excepting that such refrigerant piping may pass across a public hallway, and provided non-ferrous tubing of one (1) inch nominal outside diameter and less be contained in a rigid metal pipe.

12.52 Refrigerant piping, with or without insulation covering, shall be exposed to view, excepting for mechanical protection herein specified, or when located in the cabinet of a Unit System. This does not apply to refrigerant piping installed outside the building or in a flue vented to the outer air.

Section 13. DESIGN, CONSTRUCTION, AND SAFETY DEVICES

Design and Construction

13.10 Every part of a Refrigerating System, except pressure gauges and control mechanisms, shall be designed, constructed, and assembled to withstand the test pressures specified in Table 3, without being stressed beyond one-third (⅓) of its ultimate strength.

13.11 Equipment listed by a recognized engineering testing laboratory having a follow-up inspection service, shall be considered as conforming with the requirements of paragraph 13.10.

13.12 Refrigerant containing vessels which are not a part of equipment listed by a recognized engineering testing laboratory having a follow-up inspection service, shall be constructed in accordance with the rules of Section VIII (Unfired Pressure Vessel Section) of the 1937 A.S.M.E. Boiler Construction Code, except that compliance with paragraphs U-2 to U-10 inclusive and U-65 and U-66 of the aforsaid A.S.M.E. Code shall not be required.

13.20 Every system, except as provided in paragraphs 13.21, 13.22, and 13.23, shall be protected by a pressure relief device unless so constructed that pressure due to fire conditions will be relieved safely by soldered joints, lead gaskets, fusible plugs, or other parts of the system.

Pressure Relief Devices

*13.21** Each pressure vessel containing liquid refrigerant and which may be shut off by valves from all other parts of a refrigerating system, shall be protected by an approved pressure relief valve in parallel with a rupture member or a second approved pressure relief valve if its gross volume exceeds five (5) cubic feet unless its diameter does not exceed six (6) inches.

*It may be necessary on large pressure vessels containing liquid refrigerant to use two or more pressure relief devices in parallel to obtain the required minimum rated capacity. In such cases the battery of pressure relief devices shall be considered as a unit and therefore as one pressure relief device.

13.22 Each pressure vessel having a gross volume of five (5) cubic feet or less, containing liquid refrigerant and which may be shut off by valves from all other parts of a refrigerating system, shall be protected by an approved pressure relief device or an approved fusible plug.

13.23 The requirements of 13.21 and 13.22 shall not apply to flooded evaporators located in a refrigerator cabinet.

13.24 Each pressure vessel shall have the Design Working Pressure stamped thereon if its gross volume exceeds five (5) cubic feet.

13.25 Compressors operating above fifteen (15) pounds per square inch gauge and having a displacement exceeding one hundred (100) cubic feet per minute, shall be equipped by the manufacturer with a pressure relief device of adequate size to prevent rupture of the compressor, located between the compressor and stop valve on the discharge side. The discharge from such relief device may be vented to the atmosphere or into the low pressure side of the system.

Capacity Rating

13.30 The rated discharge capacity of a pressure relief valve, expressed in pounds of air per minute, shall be one-fifth (⅕) of its discharge capacity determined by test with the outlet open to the atmosphere and with a differential pressure across the restraining member equal to twice the marked pressure setting of the pressure relief valve.

13.32 The rated discharge capacity of rupture members and discharge piping shall be as given in Table 2.

Required Capacity

13.33 The minimum required rated discharge capacity of the pressure relief device for a refrigerant containing vessel shall be determined by the following formula:

$$C = fDL$$

Where C = Minimum required rated discharge capacity of the relief device in pounds of air per minute.

D = Outside diameter of the vessel in feet.

L = Length of the vessel in feet.

f = Factor dependent upon kind of refrigerant as follows:

Kind of Refrigerant	Value of "f"
Ammonia (NH_3)	0.1
Dichlorodifluoromethane (Freon-12)	0.3
All other refrigerants	0.2

Pressure Setting

13.34 All pressure relief devices for refrigerant containing vessels shall be directly pressure actuated.

13.35 All pressure relief valves for refrigerant containing vessels shall be set to function at a pressure not to exceed 25% above the Design Working Pressure of the vessel.

13.36 All rupture members used in parallel with pressure relief valves on refrigerant containing vessels shall be set to function at a pressure not to exceed ninety (90) per cent above the Design Working Pressure of the vessel.

Pressure Setting Test

13.37 The pressure setting of relief devices for refrigerant containing vessels shall be tested with the outlet open to the atmosphere and the relief device shall function at a pressure not more than ten (10) per cent above the pressure marked thereon, if such marking is one hundred (100) pounds per square inch or more, or at not more than ten (10) pounds per square inch above the pressure marked thereon, if such marking is less than one hundred (100) pounds per square inch.

Marking

*13.38** All pressure relief valves for refrigerant containing vessels shall be set and sealed by the manufacturer. The name or trade-mark of the manufacturer, the pressure setting expressed in pounds per square inch gauge, the rated discharge capacity expressed in pounds of air per minute, and the maximum equivalent length of discharge piping that can be attached to the pressure relief valve without loss of discharge capacity, shall be cast or stamped on the device, or on a metal plate permanently attached thereto.

13.39 Each rupture member for refrigerant containing pressure vessels shall have cast or stamped on the device or on a metal plate permanently attached thereto the name or trade mark of the manufacturer and the bursting pressure of the rupture member expressed in pound per square inch gauge.

Installation Requirements

13.40 A rupture member may be located between a pressure relief valve and a pressure vessel.

*The maximum length of discharge line which can be attached to a pressure relief valve without loss of discharge capacity may be determined from Table 2, using that length of line for the size of the discharge connection of the pressure relief valve which has twice the rated discharge capacity of the pressure relief valve at a Design Working Pressure equal to the pressure setting of the pressure relief valve.

Table 2. Discharge Capacity of Rupture Members and Discharge Piping in Pounds of Air per Minute

Maximum Relief Pressure Lbs. Per Sq. In. Gauge	Design Working Pressure, Lbs. Per Sq. In. Gauge	Pipe Length Feet	Standard Weight Pipe Nominal Size, Inches Discharge Capacity In Pounds Of Air Per Minute ½	¾	1	1¼	1½	2	2½	3
100	53	50	2.6	5.2	9.6	19.0	28	52	81	140
100	53	75	2.2	4.2	7.8	16.0	23	43	66	114
100	53	100	1.8	3.6	6.8	13.0	20	37	57	99
100	53	150	1.6	3.0	5.4	11.0	16	30	47	81
100	53	200	1.4	2.6	4.8	9.6	14	26	41	70
100	53	300	1.0	2.2	4.0	7.8	11	21	33	57
125	66	50	3.2	6.4	12.0	24.0	35	65	101	175
125	66	75	2.6	5.2	9.8	19.0	28	53	82	143
125	66	100	2.2	4.6	8.4	17.0	25	46	72	124
125	66	150	1.8	3.8	7.0	14.0	20	38	58	101
125	66	200	1.6	3.2	6.0	12.0	17	33	51	87
125	66	300	1.4	2.6	4.8	9.8	14	27	42	72
150	79	50	3.8	7.8	14.0	28	42	78	122	210
150	79	75	3.2	6.4	12.0	23	34	64	99	171
150	79	100	2.8	5.4	10.0	20	30	55	86	148
150	79	150	2.2	4.4	8.2	16	24	45	70	121
150	79	200	2.0	3.8	7.0	14	21	39	61	105
150	79	300	1.6	3.2	5.8	12	17	32	50	86
175	92	50	4.6	9.0	17.0	33	49	91	142	244
175	92	75	3.8	7.4	14.0	27	40	75	116	200
175	92	100	3.2	6.4	12.0	23	34	64	100	173
175	92	150	2.6	5.2	9.6	19	28	53	82	141
175	92	200	2.2	4.6	8.4	17	24	46	71	122
175	92	300	1.8	3.6	6.8	14	20	37	58	100
200	105	50	5.2	10.0	19.0	38	56	104	162	280
200	105	75	4.2	8.4	16.0	31	45	85	132	228
200	105	100	3.6	7.2	14.0	27	39	74	115	198
200	105	150	3.0	6.0	11.0	22	32	60	94	162
200	105	200	2.6	5.2	9.6	19	28	52	81	140
200	105	300	2.2	4.2	7.8	16	23	43	66	144
250	131	50	6.4	13.0	24.0	47	70	130	206	350
250	131	75	5.4	11.0	20.0	39	57	106	166	286
250	131	100	4.6	9.2	17.0	34	49	92	144	248
250	131	150	3.8	7.4	14.0	27	40	75	117	202
250	131	200	3.2	6.4	12.0	24	35	65	102	175
250	131	300	2.6	5.2	9.8	19	28	53	83	143
300	158	50	7.8	15.0	29	57	83	156	244	420
300	158	75	6.4	13.0	23	46	68	128	199	342
300	158	100	5.4	11.0	20	40	59	111	172	296
300	158	150	4.6	9.0	17	33	48	90	140	242
300	158	200	4.0	7.8	14	28	42	78	122	210
300	158	300	3.2	6.4	12	23	34	64	100	171
400	210	50	10.0	21.0	38	76	111	208	324	560
400	210	75	8.4	17.0	31	62	91	170	264	457
400	210	100	7.4	15.0	27	54	79	148	230	396
400	210	150	6.0	12.0	22	44	64	120	187	324
400	210	200	5.2	10.0	19	38	56	104	163	280
400	210	300	4.2	8.4	16	31	45	85	133	228
500	263	50	13.0	26	48	94	139	260	406	700
500	263	75	11.0	21	39	77	114	213	330	570
500	263	100	9.2	18	34	67	98	184	287	495
500	263	150	7.4	15	28	55	80	150	234	405
500	263	200	6.4	13	24	47	70	130	203	350
500	263	300	5.2	10	19	39	57	106	166	286

13.41 No stop valve shall be located between any automatic pressure relief device and the part or parts of the system protected thereby, except when the parallel relief devices mentioned in Par. 13.21 are so arranged that only one can be rendered inoperative at a time for testing or repair purposes.

13.42 All pressure relief devices shall be connected as nearly as practicable directly to the pressure vessel or other parts of the system protected thereby, and shall be placed above the liquid refrigerant level.

13.43 The seats and discs of pressure relief devices for refrigerant containing vessels shall be constructed of suitable material to resist refrigerant corrosion.

Discharge from Pressure Relief Devices

13.44 Pressure relief devices and fusible plugs on all systems containing more than thirty (30) pounds of refrigerant, except those used to protect compressors, shall discharge to the outside of the building in an approved manner.

13.45 The size of the discharge opening and pipe from the pressure relief device shall not be less than the size of the relief device inlet. The discharge from more than one relief device may be run into a common header, the area of which shall be not less than the sum of the areas of the pipes connected thereto.

Ammonia Discharge

13.46 Where ammonia is used, the discharge may be into a tank of water which shall be used for no purpose except ammonia absorption. At least one (1) gallon of fresh water shall be provided for every one (1) pound of ammonia in the system. The water used shall be prevented from freezing without the use of salt or chemicals. The tank shall be substantially constructed of not less than one-eighth (⅛) inch or No. 11 U. S. gauge iron or steel. No horizontal dimension of the tank shall be greater than one-half (½) the height. The tank shall have a hinged cover, or, if of the enclosed type, shall have a vent hole at the top. All pipe connections shall be through the top of the tank only. The discharge pipe from the pressure relief valves shall discharge the ammonia in the center of the tank near the bottom.

Sulphur Dioxide Discharge

13.47 Where sulphur dioxide is used, the discharge may be into a tank of absorptive brine which shall be used for no purpose except sulphur dioxide absorption. There shall be one (1) gallon of standard dichromate brine (two and one-half (2½) pounds sodium dichromate per gallon of water) for each pound of sulphur dioxide in the system. Brines made with caustic soda or soda ash may be used in place of sodium dichromate provided the quantity and strength give the equivalent sulphur dioxide absorbing power. The tank shall be substantially constructed of not less than one-eighth (⅛) inch or No. 11 U. S. gauge iron or steel. The tank shall have a hinged cover, or, if of the enclosed type, shall have a vent hole at the top. All pipe connections shall be through the top of the tank only. The discharge pipe from the pressure relief valve shall discharge the sulphur dioxide in the center of the tank near the bottom.

Pressure Limiting Devices

13.50 Pressure limiting devices are required on all systems containing more than twenty (20) pounds of refrigerant and operating above atmospheric pressure, and on all Water Cooled Systems so constructed that the compressor or generator is capable of producing a pressure in excess of the test pressure.

13.51 Pressure limiting devices shall stop the action of the compressor at a pressure less than ninety (90) per cent of the pressure relief devices setting but not more than ninety (90) per cent of the test pressures given in Table 3.

13.52 Pressure limiting devices shall be connected between the compressor and the stop valve on the discharge side.

Test of Refrigerant Containing Vessels

13.60 Refrigerant containing vessels, the shells of which have been previously tested under hydrostatic pressure of not less than one and one-half times the Design Working Pressure may be finally tested with pneumatic pressure at one and one-half times the Design Working Pressure, instead of hydrostatic pressure.

Gauges

13.70 Liquid level gauge glasses, except those of the bull's-eye type, shall have automatic closing shut-off valves, and such glasses shall be adequately protected against injury.

Motor Protection

13.80 Motors of Refrigerating Systems shall be adequately protected against hazardous overheating under normal or abnormal operating conditions.

Section 14. TESTS

General

14.10 Every refrigerant containing part of every system shall be tested and proved tight by the manufacturer at not less than the minimum test pressures shown in Table 3.

14.11 Every refrigerant containing part of every system that is erected on the premises, except compressors, safety devices, pressure gauges, and control mechanisms, that are factory tested, shall be tested and proved tight after complete installation and before operation at not less than the minimum pressures shown in Table 3.

Test Medium

14.12 No oxygen or any combustible gas or combustible mixture of gases shall be used for testing.

14.13

* * *

Table 3. Test Pressures

Refrigerant	Chemical Formula	Minimum Test Pressure, Lbs. Per Sq. In. High Pressure Side	Low Pressure Side
Ammonia	NH_3	300	150
Butane	C_4H_{10}	90	50
Carbon dioxide	CO_2	1,500	1,000
Dichlorodifluoromethane (Freon-12)	CCl_2F_2	235	145
Dichlorotetrafluoroethane (Freon-114)	$C_2Cl_2F_4$	80	50
Dichloromethane (Carrene No. 1) (Methylene chloride)	CH_2Cl_2	30	30
Dichloromonofluoromethane (Freon-21)	$CHCl_2F$	70	50
Dichloroethylene	$C_2H_2Cl_2$	30	30
Ethane	C_2H_6	1,100	600
Ethyl chloride	C_2H_5Cl	60	50
Isobutane	$(CH_3)_3CH$	130	75
Methyl chloride	CH_3Cl	215	125
Methyl formate	$HCOOCH_3$	50	50
Propane	C_3H_8	325	210
Sulphur dioxide	SO_2	170	95
Trichloromonofluoromethane (Freon-11)	CCl_3F	50	30

Refrigerants Not Listed

14.14 For refrigerants not listed in Table 3, the test pressure for the high pressure side shall be not less than the saturated vapor pressure of the refrigerant at 150° F. The test pressure for the low pressure side shall be not less than saturated vapor pressure of the refrigerant at 115° F. In no case shall the test pressure be less than thirty (30) pounds per square inch by gauge.

Posting of Tests

14.15 A dated declaration of test, signed by the installer, shall be mounted in a frame, protected by glass, and posted in the machinery room. If an inspector is present at the tests he shall also sign the declaration.

Section 15. Instructions

Users' Responsibility

15.10 All Refrigerating Systems shall be maintained in a cleanly manner, free from accumulations of oily dirt, waste, and other debris, and shall be kept readily accessible at all times.

Instructions

15.20 It shall be the duty of the person in charge of the premises on which a Refrigerating System containing more than twenty (20) pounds of refrigerant is installed, to place a card conspicuously as near as practicable to the refrigerant condensing unit giving directions for the operation of the system, including precautions to be observed in case of a breakdown or leak as follows:

a. Instructions for shutting down the system in case of emergency.

b. The name, address and day and night telephone numbers for obtaining service.

c. The name, address and telephone number of the municipal inspection department having jurisdiction and instructions to notify said department immediately in case of emergency.

Signs

15.30 Each Refrigerating System shall be provided with an easily legible metal sign permanently attached and easily accessible, indicating thereon the name and address of the manufacturer or installer, the kind and total number of pounds of refrigerant contained in the system, and the field test pressure applied.

15.31 Systems containing more than one hundred (100) pounds of refrigerant should be provided with metal signs having letters of not less than one-half (½) inch in height designating the main shut-off valves to each vessel, main steam or electrical control, remote control switch, and pressure limiting device. On all exposed high pressure and low pressure piping in each room where installed outside the machinery room, shall be signs as above with the name of the refrigerant and the letters HP or LP.

Marking

15.32 Each separately sold refrigerant containing vessel larger than five (5) cubic feet in gross volume, each refrigerant condensing unit, and each refrigerant compressor shall carry a nameplate marked with the manufacturer's name and address, identification number, and name of refrigerant used.

Helmets

15.40 One mask or helmet shall be required where amount of Group 2 refrigerants between one hundred (100) and one thousand (1,000) pounds, inclusive, are employed. If more than one thousand (1,000) pounds of Group 2 refrigerants are employed, at least two masks or helmets shall be required.

15.41 Only complete helmets or masks marked as approved by the Bureau of Mines of the United States Department of the Interior and suitable for the refrigerant employed shall be used and they shall be kept in a suitable cabinet immediately outside the machinery room or other approved accessible location.

15.42 Canisters or cartridges of helmets or masks shall be renewed immediately after having been used or the seal broken and if unused, must be renewed at least once every two (2) years. The date of filling shall be marked thereon.

Refrigerant Storage

15.50 Not more than three hundred (300) pounds of refrigerant in approved containers shall be stored in a machinery room.

15.51 No refrigerant shall be stored in a room in which less than twenty (20) pounds are used in the system.

15.52 Refrigerants on the user's premises in excess of that permitted in the machinery room shall be stored in a fireproof shed or room used for no other purpose.

Charging and Discharging Refrigerants

15.60 When refrigerant is added to a system, except a Unit System containing not more than six (6) pounds of refrigerant, it shall be charged into the low pressure side of the system. No container shall be left connected to a system except while charging or withdrawing refrigerant.

15.61 Refrigerants withdrawn from Refrigerating Systems shall only be transferred to approved containers. No refrigerant shall be discharged to a sewer.

15.62 The containers from which refrigerants are discharged into or withdrawn from a Refrigerating System must be carefully weighed each time they are used for this purpose, and the containers must not be filled in excess of the permissible filling weight for such containers and such refrigerants as are prescribed in the Interstate Commerce Commission's "Regulations for the Transportation by Rail of Explosives and other Dangerous Articles in Freight, Express and Baggage Services including Specifications for Shipping Containers," effective October 1, 1930, with supplements 1 to 18 inclusive.

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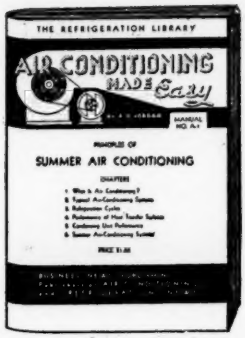

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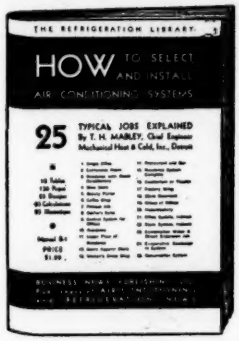

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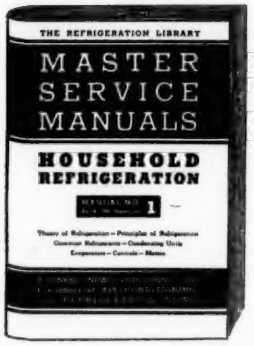

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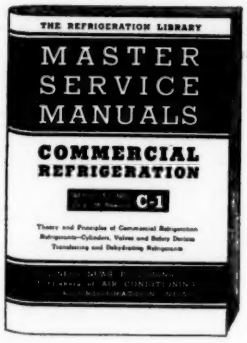

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